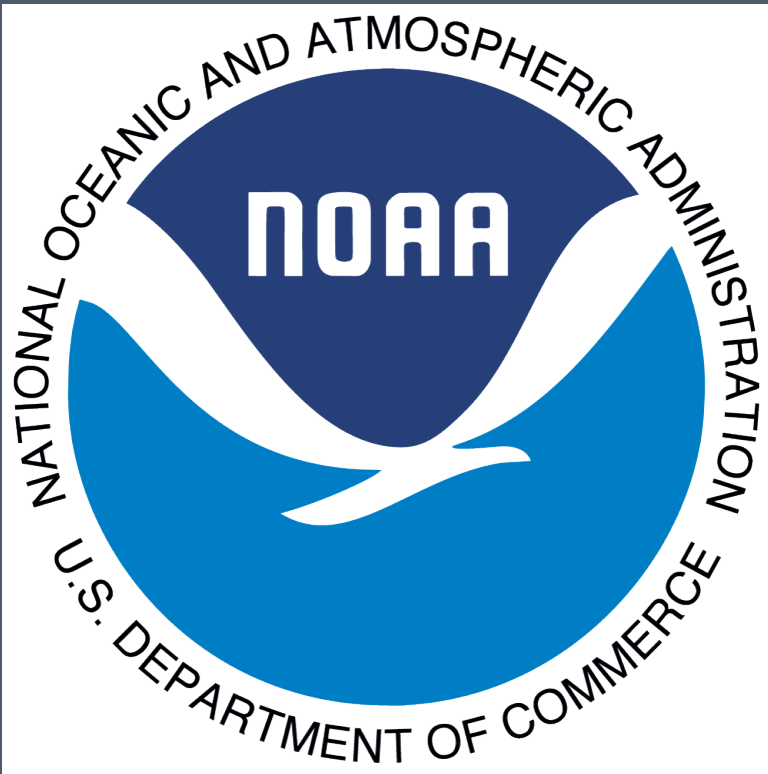# Validation of JPSS S-NPP VIIRS Surface Type Environmental Data Record

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ABSTRACT

The accurate representation of actual terrestrial surface types from regional to global scales is an important element for many applications. JPSS S-NPP VIIRS surface type environmental data record (EDR) product provides consistent global land cover classification data, which inherited the development of land cover products from the NASA's MODIS mission. The VIIRS surface type EDR is still in development, and the validated 1 stage algorithm maturity review has passed. This study introduced the process of validating the global surface type classification map and verifying the implementation of quality flags in the surface type EDR product. A visual interpretation based validation process was employed to quantitatively measure the accuracy of the classification map. Approximately 5000 ground pixels were picked by stratified random sampling and validated in an integrated validation tool, which dynamically extracts high resolution satellite images from web services, such as Google Map and Google Earth, to help the interpretations of the land cover type of the ground truth. The validation results showed that 73.92% classification accuracy has been achieved, which exceeds the 70% threshold in the level 1 requirement. The implementation of the quality flags are also verified, which suggests the surface type EDR data is ready to move forward to the next phase development.

DEVELOPMENT

The VIIRS Surface Type EDR is a swath product built by re-projecting the Gridded Surface Type Intermediate Product (GST-IP, or surface type classification map) and overlaying it with the Active Fire ARP, Snow Cover EDR, and Green Vegetation Fraction for each 750m pixel. Both VIIRS Surface Type EDR and the Global Surface Type IP provide 17 surface type classes following the IGBP classification scheme.
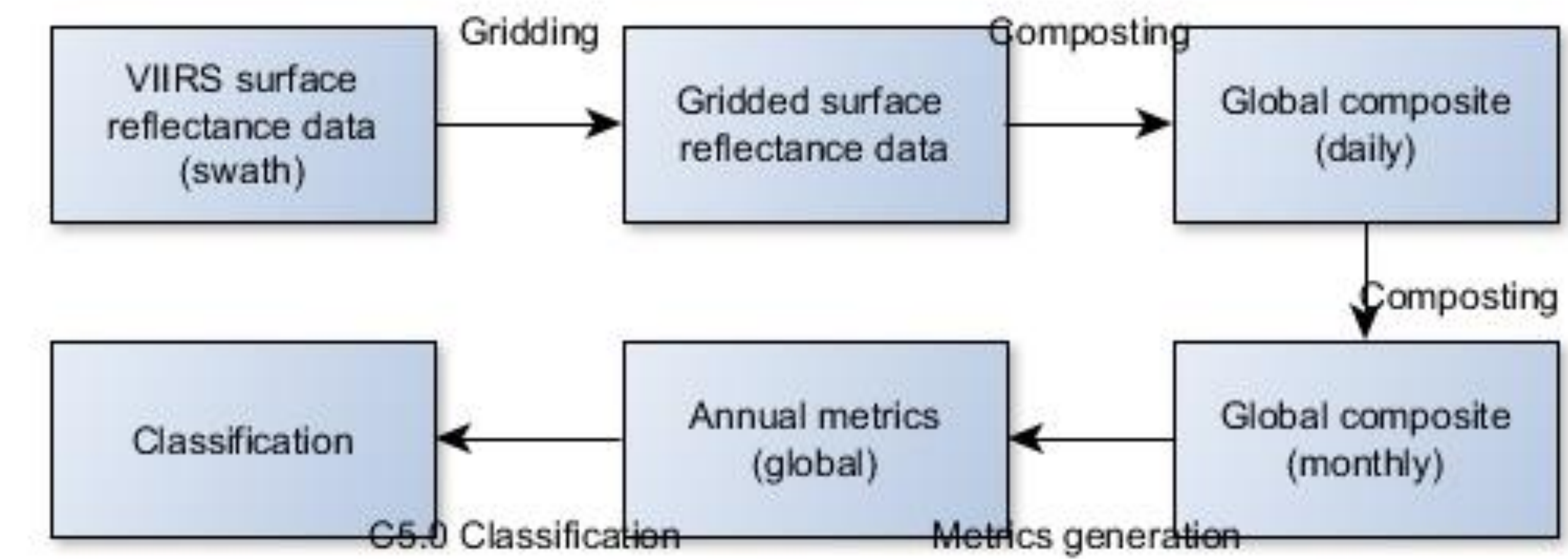
Annual metrics are input into the MODIS heritage C5.0 decision tree classifier to generate the IGBP surface type map. Details of annual metrics are listed below.

| Metrics, x: M1, M2, M3, M4, M5, M7, M8, M10, M11 |
| --- |
| Maximum NDVI value |
| Minimum NDVI value of 8 greenest months |
| Mean NDVI value of 8 greenest months |
| Amplitude of NDVI over 8 greenest months |
| Mean NDVI value of 4 warmest months |
| NDVI value of warmest month |
| Maximum band x value of 8 greenest months. |
| Minimum band x value of 8 greenest months. |
| Mean band x value of 8 greenest months. |
| Amplitude of band x value over 8 greenest months. |
| Band x value from month of maximum NDVI. |
| Mean band x value of 4 warmest months. |
| Band x value of warmest month. |

VALIDATIONS
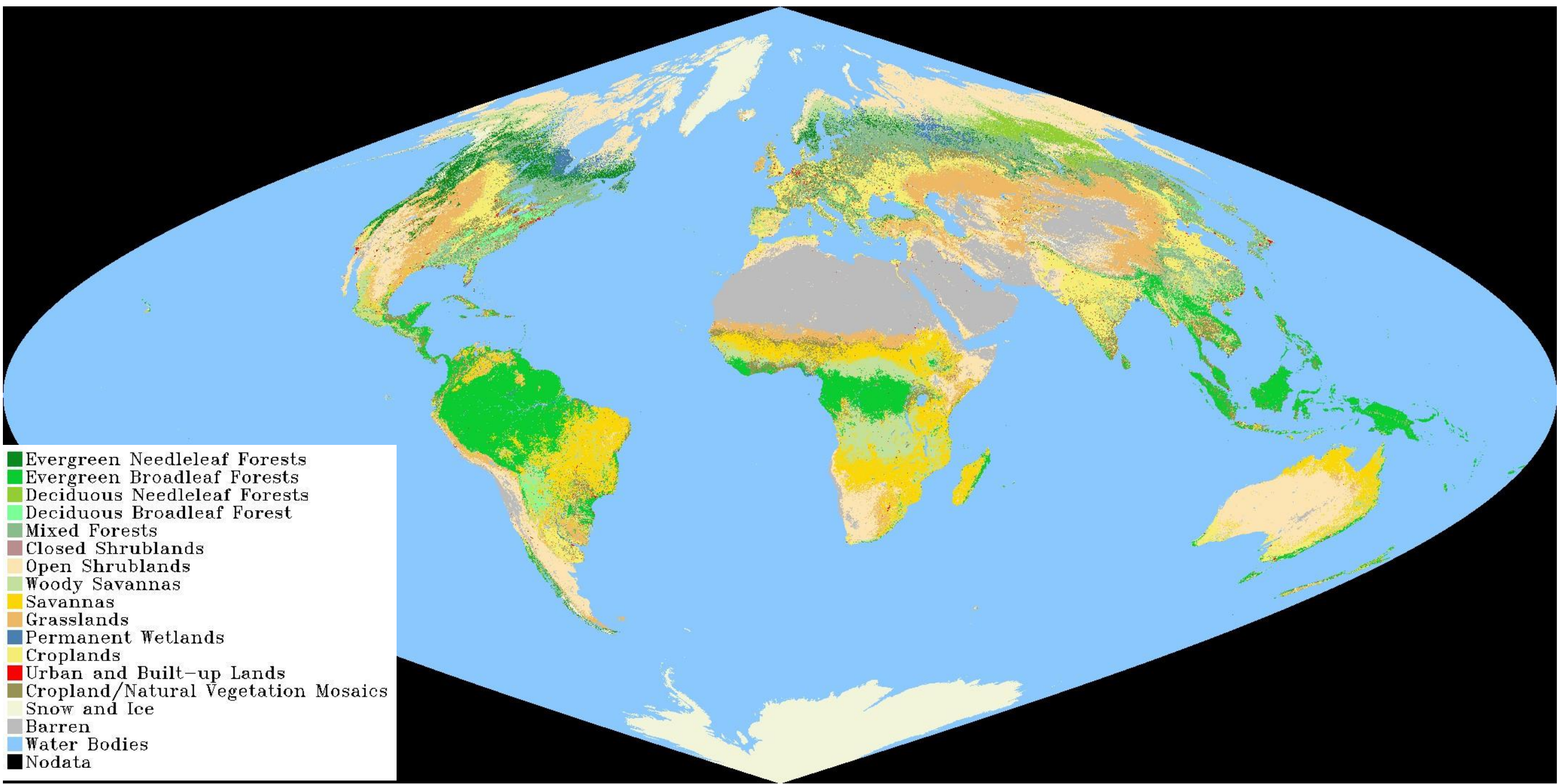
Validated 1 stage VIIRS Surface Type classification map (IP)

Approximately 5000 validation points have been selected based on a stratified random sampling approach, and visual interpretations were performed against high resolution images from Google Map/Earth.
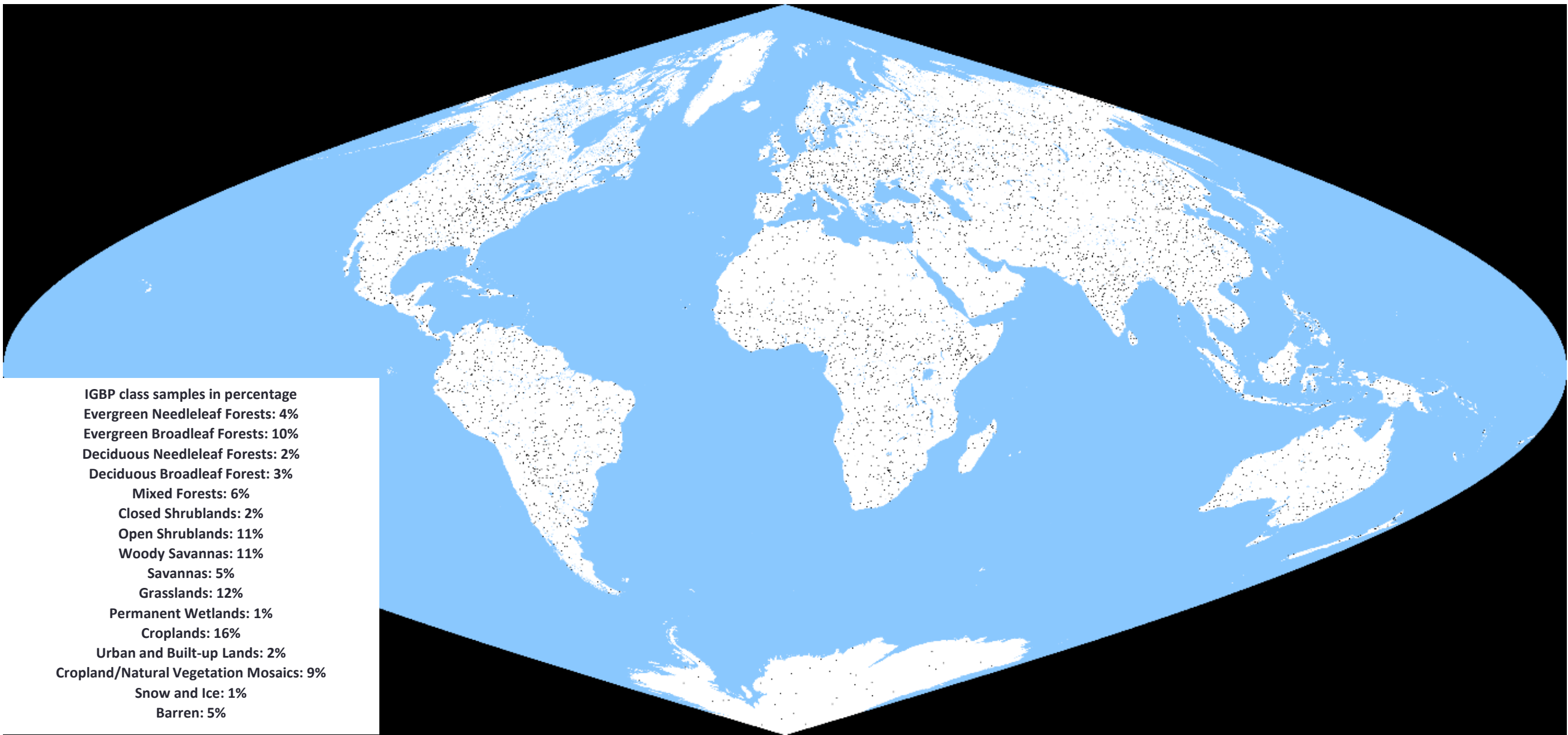

An integrated validation tool was developed.
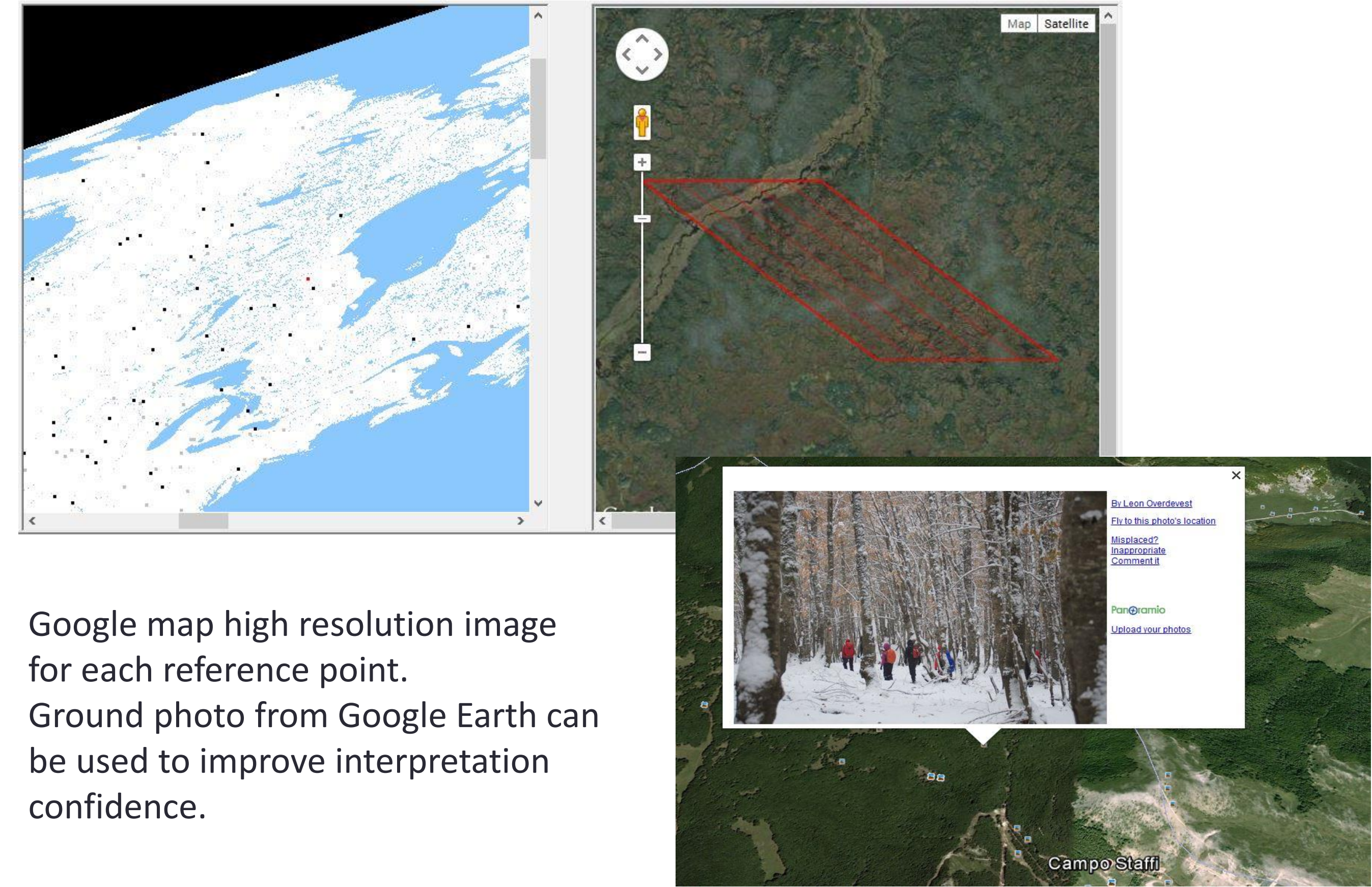
Google map high resolution image for each reference point.
Ground photo from Google Earth can be used to improve interpretation confidence.
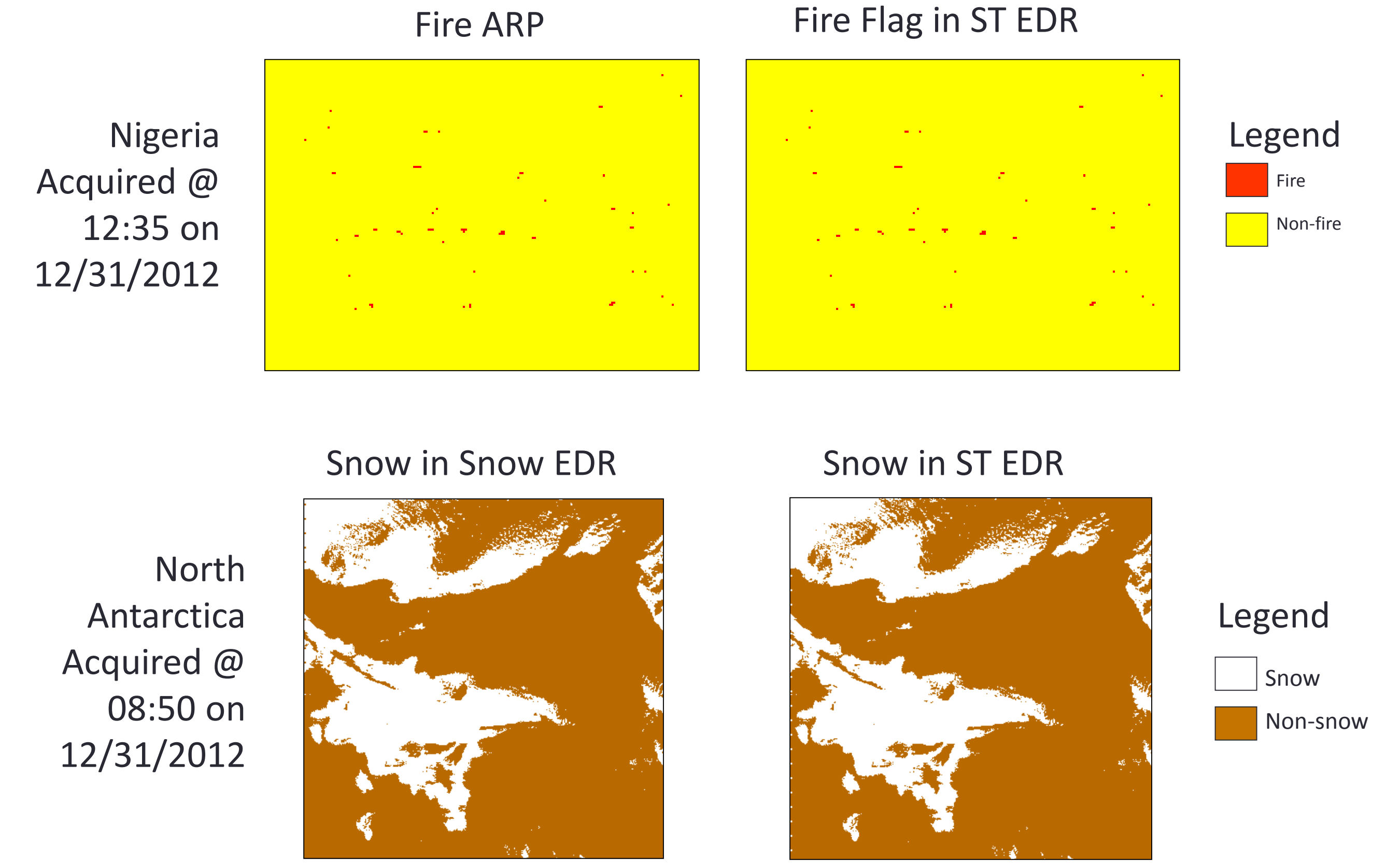
RESULTS

	ENL	EBL	DNL	DBL	Mix	C. Shurb	O. Shurb	Woody	Sav	Grass	Wet	Crop	Urban	Crop mos	Snow/Ice	Barren
ENL	85.98	0	3.85	1.43	10.74	0	0.2	3.4	1.12	0.18	2.38	0.13	0	0	0	0
EBL	0	94.09	0	1.9	3.7	0	0	4.29	2.8	0	0	0.13	0	0.73	0	0
DNL	2.44	0	71.15	0	2.59	0.9	0	1.61	0.28	0	0	0	0	0	0	0
DBL	0	0	0.96	55.24	2.59	0	0	2.15	2.52	0.36	0	0	0	0.73	0	0
Mix	4.88	0.61	17.31	22.38	66.3	0	0	6.44	1.68	0.36	0	0.13	1.02	1.95	0	0
C. Shrub	0.61	0	1.43	0.37	62.16	1.81	0	6.34	0.84	0	0	0.13	0	0.97	0	0
O. Shurb	1.22	0	0	0.48	1.48	15.32	80.89	0.89	0.84	9.79	9.52	1.73	1.02	2.19	0	8.42
Woody	3.05	2.24	4.81	9.05	6.3	5.41	1.21	64.04	15.69	1.42	2.38	1.33	2.04	7.3	0	0
Sav	0	0.61	0	0.48	0.74	4.5	1.41	4.83	47.9	1.42	0	0.66	1.02	3.41	0	0
Grass	0.61	0	0	1.9	1.11	9.91	10.06	2.33	5.88	72.06	0	6.12	2.04	3.41	0	5.26
Wet	0.61	0	0	0.48	1.48	0	0.38	0.36	1.12	0.36	80.95	0.13	0	0	0	0
Crop	0.61	0	0.96	1.9	0.74	0.9	1.01	0.89	5.32	9.07	4.76	83.38	8.16	15.57	0	0
Urban	0	0.2	0	0	0	0	0.2	0.36	0.28	0.18	0	1.33	81.63	0.97	0	0.35
Crop mos	0	2.24	0.96	3.33	1.85	0.9	1.81	8.05	13.73	4.27	0	4.65	3.06	62.77	0	0.35
Snow/Ice	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0
Barren	0	0	0	0	0	0.6	0	0	0.53	0	0.13	0	0	0	0	85.61
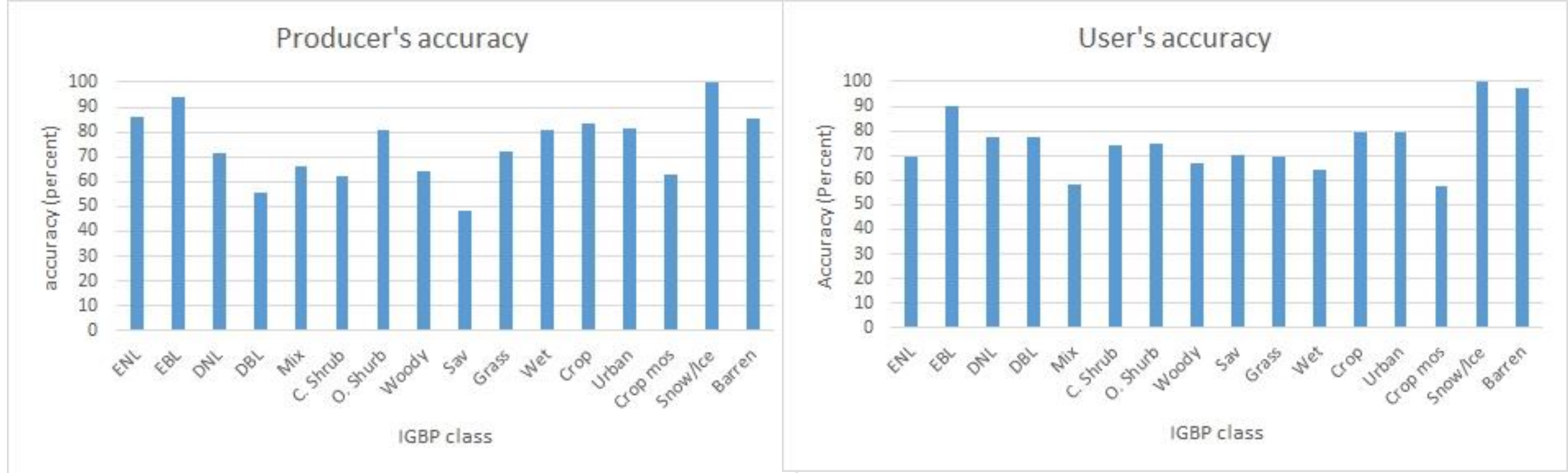
Overall accuracy in IGBP: 73.92% (required 70%)

QUALITY FLAGS

Active fire and snow/ice information are contained in the quality flags of the surface type EDR. These information are also verified.

Fire ARP | Fire Flag in ST EDR

Nigeria Acquired @ 12:35 on 12/31/2012

Legend
Fire
Non-fire

Snow in Snow EDR | Snow in ST EDR

North Antarctica Acquired @ 08:50 on 12/31/2012

Legend
Snow
Non-snow